REAL ECONOMIC CONVERGENCE IN THE EU ACCESSION COUNTRIES

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Abstract

The paper aims to assess the real economic convergence among eight CEE countries that accessed the EU, as well as their convergence with the EU. Two aspects of convergence are analysed: (a) income convergence as a tendency to close the income gap; (b) cyclical convergence as a tendency to the conformity of business cycles. Income convergence is analysed in terms of *b* and *s* coefficients using regression equations between GDP per capita levels and GDP growth rates. Cyclical convergence is analysed using industrial production indexes and industrial confidence indicators. The analysis covers the period 1993-2004. The main findings may be summarised as follows: 1) CEE countries converge between themselves and towards the EU as regards the income level; 2) CEE countries reveal a good cyclical synchronisation with the EU; cyclical conformity within the region is better seen when the group is split into three subgroups: (a) Czech Republic, Slovakia and Slovenia, (b) Hungary and Poland, (c) the Baltic states. Both types of economic convergence are strongly affected by the dependence on the EU markets, including trade and capital flows.

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1. Introduction

The concept of real economic convergence includes two aspects: (a) a tendency towards the equalisation of income and development levels, which may be called growth or income convergence, (b) a tendency among the countries towards the conformity of their business cycles, which may be called cyclical convergence.

Both concepts of economic convergence are basically independent and have to be tested separately. The countries coming closer as regards their income levels need not reveal similar cyclical fluctuations and *vice versa*, the countries with similar cyclical fluctuations need not come closer as regards their income levels.

Even if income convergence may be derived from the intrinsic mechanism of economic growth, both types of economic convergence are closely related to international cooperation, including trade and capital flows, technology transfer, labour movement, increased competition, economies of scale, and policy coordination. Thus, there may be some interdependence, or at least correlation, between the two aspects of economic convergence, especially among the countries subject to an advanced integration process, which is the case in the enlarged EU.

While the traditional trade theory (Viner, 1950) implied that economic integration would lead to more convergence, some newer theories based on the new geography approach (Krugman, 1991) warned that integration might also result in rising income inequalities. The same is suggested by some newer growth models (Romer, 1986; Lucas, 1988), which refer to R&D efforts and brain drain. One of the most comprehensive empirical studies until now (Ben-David, 2002)

concluded that *per capita* income levels throughout the world over the period 1960-1985 have rather diverged. Thus, the debate about economic convergence and the effects of integration is by no way closed. This means that there is still much room for discussion about the factors conducive to economic convergence or divergence, and a need for empirical research focusing on different groups of countries.

This paper aims to assess growth and cyclical convergence among the eight CEE countries that have recently accessed the EU: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia, as well as their convergence to the EU 'core'. Income convergence (a tendency to reduce the income gap) will be analysed by comparing real GDP *per capita* levels and growth rates, and cyclical convergence (a tendency towards a uniform pattern of cyclical fluctuations) will be assessed by industrial production indices and industrial confidence indicators.

There are many analyses of growth patterns in the CEE area, including our own (Matkowski, 2004). For a comprehensive review see: Havrylyshyn (2001). There were also many analyses of economic convergence of CEE countries towards the EU (e.g. Baldwin *et al.*, 1997; Breuss, 2001; European Commission, 2001; Doyle *et al.*, 2001; Lejour *et al.*, 2001; Martín *et al.*, 2001; Sarajevs, 2001; Marini, 2003; EEAG, 2004; Kutan and Yigit, 2004; Kejak *et al.*, 2004; Fidrmuc and Korhonen, 2004). Most of them refer to the income-level convergence, but some also include examination of cyclical conformity. However, we saw no study devoted to both aspects of economic convergence between those countries and towards the EU. Most probably, this is the first such attempt, which supplements our earlier analysis (Matkowski and Próchniak, 2004).

The paper consists of six parts. Section 1 is this introduction. Section 2 specifies the data used. Section 3 explains the concept of income convergence and presents the empirical results. Section 4 brings the results on cyclical convergence. Section 5 analyses trade

links between CEE countries and the EU, which are essential in any reasoning about economic convergence. Section 6 presents the conclusions.

2. Data

For the purposes of our analysis we have compiled the following data:

a) GDP *per capita* at PPP (US $) for the individual CEE countries as well as for the former EU members;
b) GDP *per capita* at PPP (US $) for the whole group of CEE countries and for the EU-15 area, calculated by dividing total GDP and total population of all the countries included in a group;
c) industrial production indexes for CEE countries and the euro area;
d) industrial confidence indicators (based on survey data) for CEE countries and the euro area;
e) trade flows between CEE countries and their major trade partners.

Annual GDP *per capita* data for the period 1993-2003 have been derived from IMF *World Economic Outlook Database* (April 2004). Monthly data on industrial production are taken from web pages of CEE Central Statistical Offices. In the case of the Czech Republic and Slovakia they are supplemented by OECD data from *Main Economic Indicators*. In the case of Lithuania data on industrial production are taken from the Lithuanian statistical bulletin. Data on industrial confidence are mostly taken from OECD *Main Economic Indicators*. In the case of Slovenia and Lithuania the OECD data were updated using national statistical bulletins. Data on industrial production and industrial confidence cover various periods (maximum 10 years: January 1995 – April 2004). Some quarterly data have been interpolated into monthly indices.

GDP *per capita* data are analysed in a natural-logarithm form. Time series of the industrial production index were transformed into growth rates against the same month of the previous year if source data had other basis (in order to eliminate seasonality and to avoid

instationarity), then smoothed with 12-month moving average and standardised. Time series of industrial confidence indicators, originally expressed as net answer balances, were only transformed into 2000 = 100 form (assuming that they are stationary by their very nature), smoothed by 12-month moving average, and standardised. Towards the end of period the moving average was successively shortened as to avoid cutting the series at the end. After these transformations both the industrial production indexes and industrial confidence indicators (except perhaps for the first and the last year) do not reveal seasonal fluctuations and irregular movements, and they are comparable. Data on trade flows come from the newest EBRD *Transition Report* and IMF *Direction of Trade Statistics*. They have been converted into percentage shares of total exports and imports of the countries concerned.

3. Income convergence

3.1. Theoretical framework

One of the most important conclusions from neoclassical models of economic growth (Solow, 1956; Mankiw *et al.*, 1992) is their confirmation of growth convergence, or more precisely, conditional *b*-convergence. This means that a less developed economy (with a lower GDP *per capita*) tends to grow faster than a more developed one. The convergence is conditional because it takes place when both economies tend to reach the same steady-state. If the less developed economy always grew faster, we would deal with absolute convergence.

Another measure is *s*-convergence. It appears if income differences between the economies concerned decrease over time. Income differentiation can be measured by the variance or standard deviation of real GDP *per capita*. *b*-convergence is a necessary but not sufficient condition for the existence of *s*-convergence. Income differences between countries can rise and at the same time less developed countries may develop faster (Barro and Sala-i-Martin,

1992). The main argument behind the convergence hypothesis is that, given the same exogenous technology, countries with low *per capita* income and low capital per worker would offer higher returns to capital.

This would attract more foreign capital, insuring a higher accumulation rate and faster growth. The evident condition is that the economies concerned are open. Empirical results on income convergence depend to a large extent on the homogeneity of analysed group of countries. The analyses that include more or less similar economies (e.g. OECD members) confirm the existence of convergence, whereas the analyses comprising different groups of countries bring some evidence of income-level divergence. Let us present the conclusions from the Solow model concerning the conditional *b*-convergence. In particular, we wish to show that (*i*) an economy starting from a low GDP *per capita* level (and low capital per worker) and tending towards a steady-state may grow faster than the economy starting from a higher income and capital level; (*ii*) economies approaching different steady-states need not converge.

The basic equation which describes the drive of the economy towards a steady-state in the Solow model is:

$$\dot{k}_t = sf(k_t) - (n + x + d)k_t \quad \text{or} \quad g_k = s\frac{f(k_t)}{k_t} - (n + x + d), \quad \text{(1a, 1b)}$$

where:

k – capital per unit of effective labour,

$\dot{k}$ – increase of capital per effective labour unit,

g_k – growth rate of capital,

n – growth rate of population,

x – rate of exogenous technical progress,

d – rate of capital depreciation,

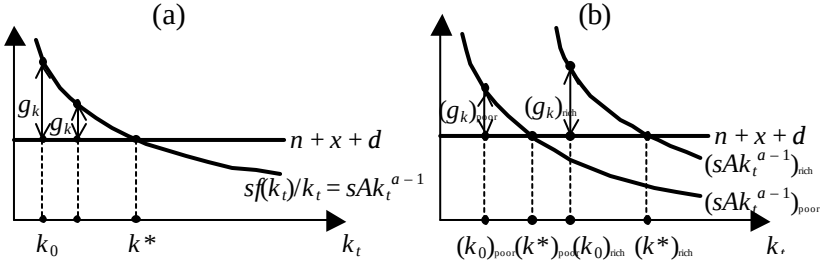
s – saving rate,

$f(k)$ – production function.

Since output is proportional to capital (according to the neoclassical production function), similar equations characterise the dynamics of GDP per unit of effective labour. The best way to prove (*i*) is to draw both parts of equation (1b) on the chart. This is shown in Figure 1a. The growth rate equals to the vertical distance between the curve $sf(k_t)/k_t$ and the line $n + x + d$. The economy starting from capital level k_0 and reaching the steady-state capital value k^* would reveal a decreasing growth rate. Thus, less developed economy would grow faster than a more developed one.

The convergence is conditional because it is limited to the situation when both economies tend to reach the same steady-state. In order to prove (*ii*), let us consider two countries: a poor one and a rich one, with different saving rates. Since saving rate in the rich country is higher, the steady-state value of capital in the rich country is also higher than in the poor country. This is shown in Figure 1b. Although the rich country starts from a higher capital level, now it also reveals a more rapid growth, because it tends to a different steady-state than the poor country. In this case, both economies would not converge. Thus, we have proved that *b*-convergence is conditional.

Figure 1. Economic growth in the Solow model



An important target of empirical research is to estimate the value of parameter b, which determines the speed of convergence towards the steady-state, according to the following equation:

$$g_y \approx b\left(\ln y^* - \ln y_t\right). \tag{2}$$

The parameter b informs what part of the distance from the steady-state the economy is covering during one period. For example, if $b = 0.02$, the economy covers annually 2% of the distance.

In order to calculate b in an empirical analysis, we have to estimate the following regression equation:

$$\frac{1}{T}\ln\frac{y_T}{y_0} = a_0 + a_1 \ln y_0 . \tag{3}$$

This equation allows us to verify the existence of b-convergence. The explained variable is the average annual growth rate of real GDP *per capita* between period T and 0 while the explanatory variable is GDP *per capita* level in period 0. If parameter a_1 is negative, b-convergence exists. In such a case we can derive the value of b from:

$$b = -\frac{1}{T}\ln\left(1 + a_1 T\right). \tag{4}$$

Estimating this equation enables us to verify the existence of b-convergence.

3.2. Income convergence among the CEE countries

Here we wish to test empirically the existence of b- and s-convergence among the CEE countries. It is interesting to see whether the less developed economies in this region grew faster than the more developed ones during the transition period.

b-convergence

The analysed group began the transition process towards an open market economy with a transformation crisis marked by a deep fall of GDP in early 1990s. For example, in a single year 1992 real GDP *per*

capita fell by 21.7% in Estonia, 21.3% in Lithuania, and 34.9% in Latvia (IMF, 2002). In most CEE countries the crisis ended till 1993. Since then most CEE countries have revealed continuous economic growth.[1]

Due to the similar development level, similar economic structures, and largely the same course of economic reforms, but also due to regional cooperation and common policies aimed at the EU accession, the CEE countries should reveal some income-level convergence. The more so because the EU has pursued a deliberate structural and regional policy aimed at reducing development differences. Financial aid was mainly addressed to less developed regions and countries to stimulate their economic growth.

In order to verify *b*-convergence, we have to estimate the slope of regression equation (3). We did this for the whole period 1993-2003 as well as for two equal-length subperiods: 1993-1998 and 1998-2003. The results are presented in Table 1 and in Figure 2.

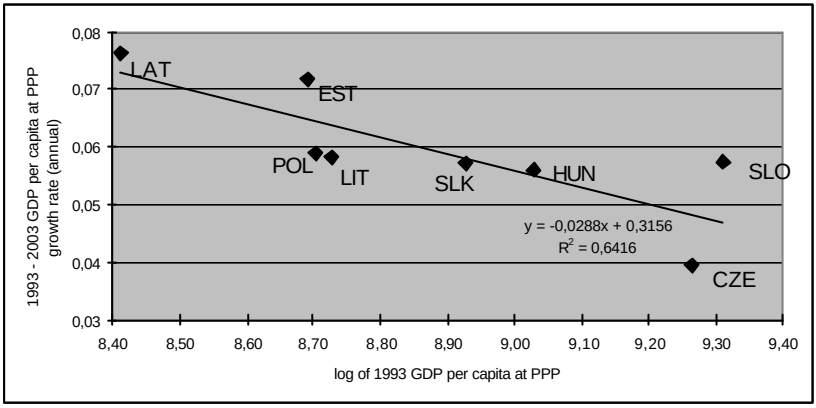
Table 1. Regression results for *b*-convergence

Period	$\hat{a}_0$	$\hat{a}_1$	$t_{\hat{a}_0}$	$t_{\hat{a}_1}$	R^2	*b*-conv.	$\hat{b}$
1993-2003	0.32	–0.03	4.04	–3.28	0.6416	yes	0.0340
1993-1998	0.29	–0.03	2.52	–1.98	0.3942	yes	0.0269
1998-2003	0.40	–0.04	2.74	–2.35	0.4797	yes	0.0409

[1] However, over the period 1989-2002, only Poland, Slovenia, and Hungary have noticed a considerable increase in real GDP: by 30%, 18%, and 12% respectively. In the Czech Republic and Slovak Republic the increase was less than 10%. The Baltic states saw a decrease as compared to 1989: Estonia by 7%, and Latvia and Lithuania by 23% (EBRD, 2003).

The first column in Table 1 indicates the period. The next columns give the estimated values of parameters a_0 and a_1, *t*-statistics, *p*-values, and R^2. The last two columns inform about the existence of *b*-convergence (answer is 'yes' if GDP growth rate is negatively correlated with the initial income level), giving the estimated value of *b* coefficient.

Figure 2. GDP *per capita* growth rate over the period 1993-2003 and the initial GDP *per capita* level



For each analysed period the results confirm the existence of *b*-convergence. It means that less developed countries within the group grew faster than more developed ones. For example, Latvia and Estonia, the poorest CEE economies in 1993, recorded the highest growth rate over the period 1993-2003. The value of *b* coefficient for the whole period is 3.4%.

This indicates a weak income-level convergence between CEE countries but a relatively fast one compared with 2% as reported by some other studies (Hagemann, 2004). Given our estimate of the rate of convergence, CEE countries would need about 20 years to reduce by a half the distance to their common steady-state. This means that although catching-up process between the eight CEE economies is

evident, the equalisation of their development levels will take a lot of time.

A more precise analysis shows that b coefficient in the second subperiod 1998-2003 (4.1%) was significantly higher than in the first subperiod 1993-1998 (2.7%). It is very likely that a faster convergence in the second subperiod was linked to the planned EU enlargement. In the early years of transition adjustment and structural policies were not yet strongly pursued.

When approaching the EU accession, the less developed countries within this group have managed to accelerate their growth. This is best evidenced by the Baltic states, which grew very rapidly in the 2000s. Our findings about the existence of convergence are supported by quite good regression statistics ($R^2 = 0.64$ for the whole period) and significance of explanatory variables ($P < 0.05$ for the whole period).

Figure 2 shows a negative correlation between the average annual GDP *per capita* growth rate over the period 1993-2003 and the initial GDP *per capita* level. The points marked on the chart, indicating the position of individual countries, fit very well the trend line, indicating an evident convergence.

s-convergence

As our research has largely confirmed the existence of *b*-convergence among the CEE countries, we would also like to know whether income differentiation among them has also decreased. In order to answer this question, we have to test *s*-convergence.

Although the less advanced CEE countries grow in general faster than the more advanced ones, income dispersion between them need not to decrease systematically. There are various random demand and supply shocks, both internal and external, that affect the individual economies and throw them temporarily away from the path towards the steady-state.

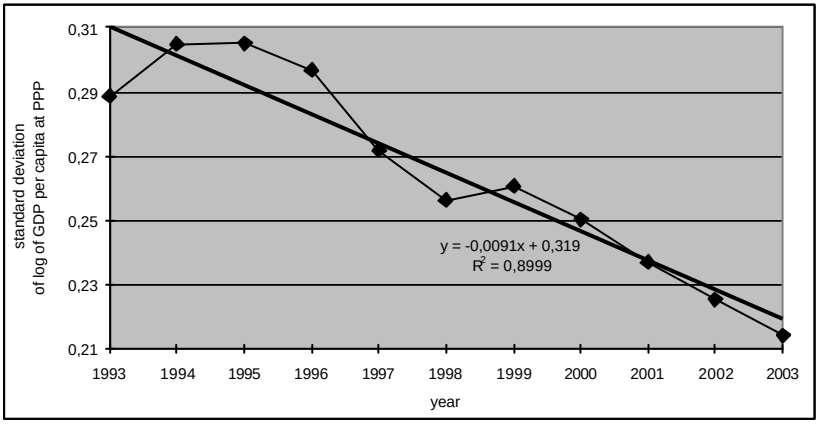
To test s-convergence we analysed income dispersion by estimating the trend line of standard deviation of log GDP *per capita*.

The calculations were made for the whole period 1993-2003 as well as for two subperiods: 1993-1998 and 1998-2003. The results are presented in Table 2 and Figure 3. s-convergence exists if the trend line slopes down, meaning that income dispersion tends to decline.

Table 2. Regression results for s-convergence

Period	$\hat{a}_0$	$\hat{a}_1$	$t_{\hat{a}_0}$	$t_{\hat{a}_1}$	R^2	s-conv.
1993 – 2003	0.32	–0.01	46.75	–8.99	0.8999	yes
1993 – 1998	0.31	–0.01	22.58	–2.15	0.5359	yes
1998 – 2003	0.32	–0.01	26.32	–6.67	0.9174	yes

Figure 3. Standard deviation of GDP *per capita*, 1993-2003



The results for the whole period confirm the existence of s-convergence. The decreasing trend of income dispersion between these countries is also clearly visible in Figure 3. Our findings are also supported by very good regression statistics ($R^2 = 0.90$, $P = 0.000$).

Figure 3 also shows that even if income dispersion among the CEE countries was generally decreasing, in some years it rose. At the beginning of the period, in the years 1993-1995, income differentiation among those countries increased. Since 1996 (except of 1999) it has been decreasing, as confirmed by regression results for the second subperiod of 1998-2003.

3.3. Income convergence towards the EU

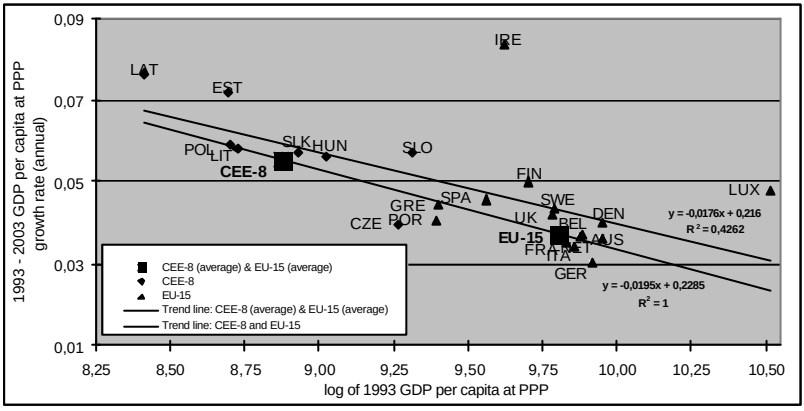
Our empirical analysis also confirms the existence of *b*-convergence between CEE countries and the EU-15. *b*-convergence has been evidenced for both the individual countries as well as for the whole regions. Figure 4 shows that the average annual growth rate during 1993-2003 for current 23 EU members was inversely related to their initial GDP *per capita* level.

In Figure 4, the position of individual countries has been marked by dark rhombuses (CEE countries) and triangles (former EU members). As we can see, there is an evident negative relation between the initial income level and the growth rate. The estimated trend line for 23 EU countries, including 15 former EU members and 8 new entrants, has a slope –0.0176, which implies that *b*-coefficient is 1.94%. The value of R^2 is deteriorated mainly due to two countries which diverge much from the common experience: Ireland and Luxembourg. If we could exclude these two untypical cases from our calculations, we would get significantly better regression results.

The convergence is also seen in a regional approach. The big squares in Figure 6 indicate the initial average GDP *per capita* level and the average GDP growth rate in the EU-15 and among the CEE countries. The average growth rate in the CEE was higher than in the EU-15 while the initial GDP *per capita* was much lower. The trend line for the two regions has a slope –0.0195 ($R^2 = 1$ is obvious) with *b*-coefficient equal to 2.17%.

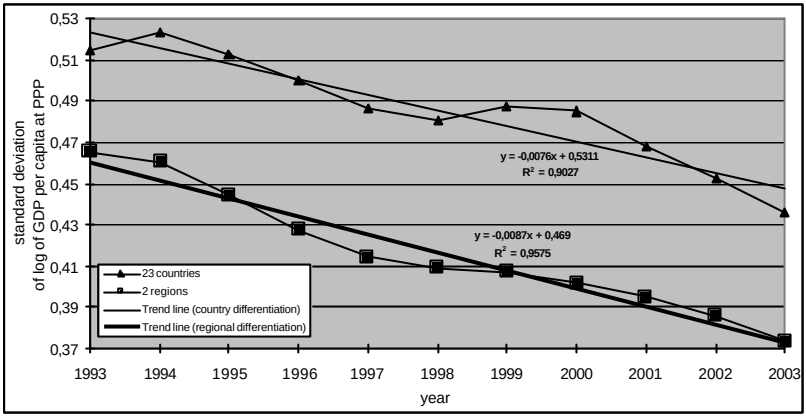
The above analysis indicates a relatively slow convergence process between the new EU entrants and the former EU member countries as regards income-level equalisation. We should not expect a rapid equalisation of the average income level in CEE and EU-15. The *b* coefficient equal to ca 2% indicates that the least developed countries of the extended EU would need about 35 years to decrease by a half their income gap towards the leader. This means that 35 years will go by before the CEE economies increase their income level from the current 50% to 75% of the EU-15 average.

Figure 4. GDP *per capita* growth rate over the period 1993-2003 and the initial GDP *per capita* level



The new and old EU members also reveal *s*-convergence, both in the country-by-country examination and in a regional approach. Figure 5 presents the tendency of the standard deviation of GDP *per capita* between 23 countries of the enlarged EU and between the two subgroups including the new and old EU members.

Figure 5. Standard deviation of GDP *per capita*, 1993-2003



As we can see, the difference between the CEE countries and the EU-15 as regards the average income level is clearly decreasing (slope of the trend line = –0.0087, R^2 = 0.96). It means that the income levels in the new EU countries become closer to the average income level seen in the EU-15 (though the income gap is still very large). The differences in income levels tend also to decrease in the cross-section analysis including all the 23 countries (slope –0.0076, R^2 = 0.90).

3.4. What is new in our findings?

Comparing our findings with the results of other empirical analyses, there are some differences caused by different source data, countries, and indicators analysed, and the period covered. Our previous analysis (Matkowski and Próchniak, 2004) on economic convergence of the EU accession countries, that covered the period 1993-2001 and was based on *Euromonitor* data, indicated a significantly weaker speed of convergence. Estrin *et al.* (2001) did not found any convergence between 26 post-socialist countries and well developed economies during the period 1970-1998.

Only Hungary, Czech Republic, and Slovak Republic proved a real convergence towards well developed economies. Koèenda (2001)

indicates some evidence of stochastic convergence of industrial production indices in all the analysed groups of post-socialist countries in the period 1991-1998. However, the updated and slightly modified analysis of Kutan and Yigit (2004) does not confirm a regular existence of convergence.

The EU enlargement contributed to several theoretical papers concerning the convergence process. Kejak *et al.* (2004) extended the two-sector Uzawa-Lucas endogenous growth model so as to explain the growth path of new EU countries. They used this modified model to estimate the speed of income equalisation between Poland, Czech Republic, and Hungary, and the EU-15. Under an optimistic assumption of the growth rate of 4%, Poland would achieve the current GDP *per capita* average level of EU-15 in 35 years, the Czech Republic – in 23 years, and Hungary – in 30 years.

However, under a more realistic assumption about the growth rate of 3%, the Czech Republic may suffer from a temporary recession just after the EU accession whereas Poland and Hungary would face the recession following the strong economic growth at the beginning of their EU membership.

The newest EEAG report (EEAG, 2004) includes some estimations concerning the catching-up process of CEE countries. The most optimistic data suggest that Slovenia would reach the income level equal to 90% of the future average for the euro area in 30 years. In the same time, the Czech Republic, Hungary and the Slovak Republic would achieve 75-80% of the EU-15 average, whereas Poland and the Baltic states 65-70%. If the conclusions about growth convergence among the CEE countries arising from the previous analyses have been quite uncertain, this study is the first to confirm the existence of clear-cut income-convergence between the CEE and towards the EU.

4. Cyclical convergence

4.1. Assumptions and the method

The eight CEE countries included in this group are more or less similar as regards their development level, economic structure, progress of transformation, economic policies, international links, and the dependence on foreign markets. Thus, it is very likely that economic growth of these countries is determined by similar factors. We may also suppose that they would react similarly to internal and external shocks. If our assumptions are correct, it is very likely that the analysed countries would also reveal similar cyclical fluctuations. However, this hypothesis should be explicitly proved.

At the same time, all the CEE countries now are largely engaged in trade with Western Europe, being also heavily dependent on FDI-inflows. Therefore, we may expect that they will develop more or less similarly to the EU 'core' as represented by the euro area.

Our analysis covers the period from January 1995 till April 2004, for which we have the necessary data. We analyse here monthly data on the growth rates of industrial production (year-over-year), as reported by official statistics, and industrial confidence indicators, compiled from business surveys. All the data have been smoothed with 12-month moving average (successively shortened at both ends in order to avoid cutting the series), and normalised against the long-term average.

Cyclical conformity can be assessed by means of correlation coefficients. If the correlation is high, we may assume that there is a good synchronisation of cyclical developments. We must, however, be aware about spurious correlations, which may be purely accidental or due to the both-side dependence on a third common market, notably the EU. Our analysis of cyclical convergence among the new EU entrants supplements the earlier studies on cyclical convergence within the EU (e.g. J. Kröger *et al.*, 2003).

4.2. Cyclical conformance within the CEE

Industrial production

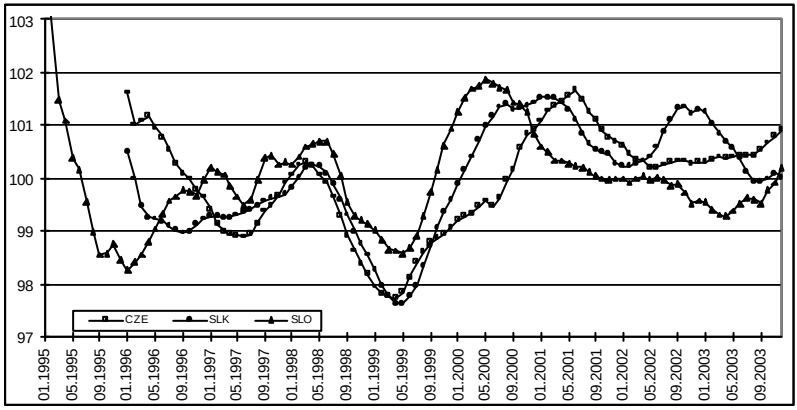
Correlation coefficients between industrial production growth rates in the analysed countries are presented in Table 3. The grey cells show significant positive correlations, suggesting cyclical convergence.

Table 3. Correlation coefficients of industrial production

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
CZE	1.00	-0.36	*ns*	0.72	*ns*	0.37	0.72	0.82
HUN	-0.36	1.00	0.47	*ns*	0.59	*ns*	*ns*	-0.37
POL	*ns*	0.47	1.00	*ns*	0.20	0.20	*ns*	*ns*
SLK	0.72	*ns*	*ns*	1.00	0.53	0.66	0.73	0.61
SLO	*ns*	0.59	0.20	0.53	1.00	0.39	*ns*	-0.33
EST	0.37	*ns*	0.20	0.66	0.39	1.00	0.81	0.38
LAT	0.72	*ns*	*ns*	0.73	*ns*	0.81	1.00	0.72
LIT	0.82	-0.37	*ns*	0.61	-0.33	0.38	0.72	1.00

ns – not significant.

Figure 6. Industrial production



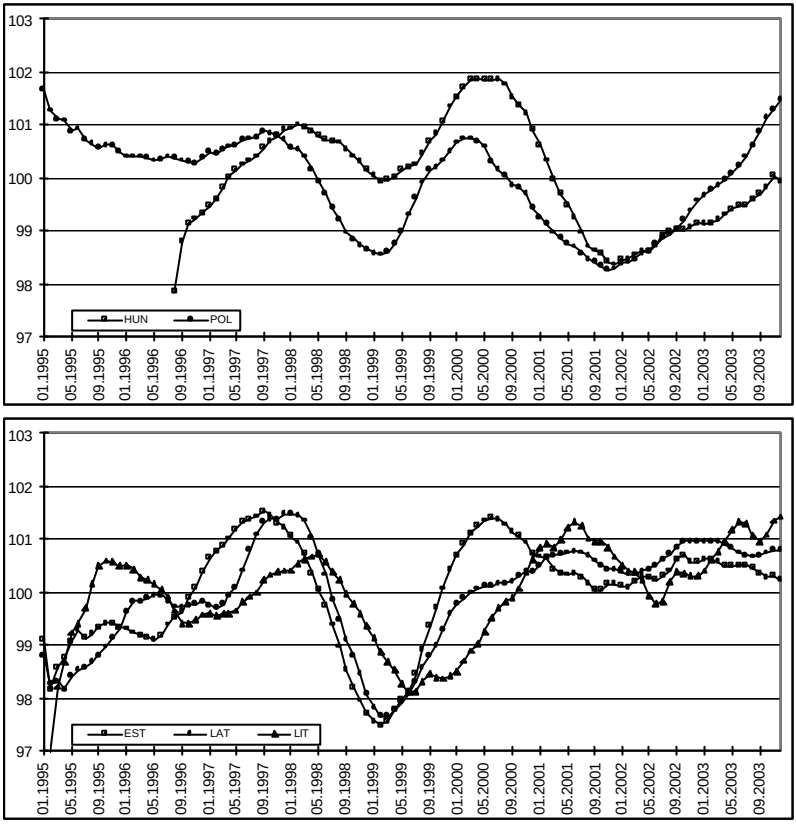
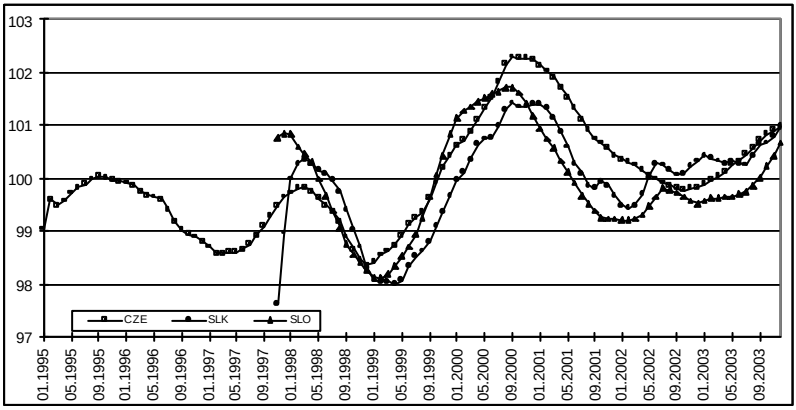
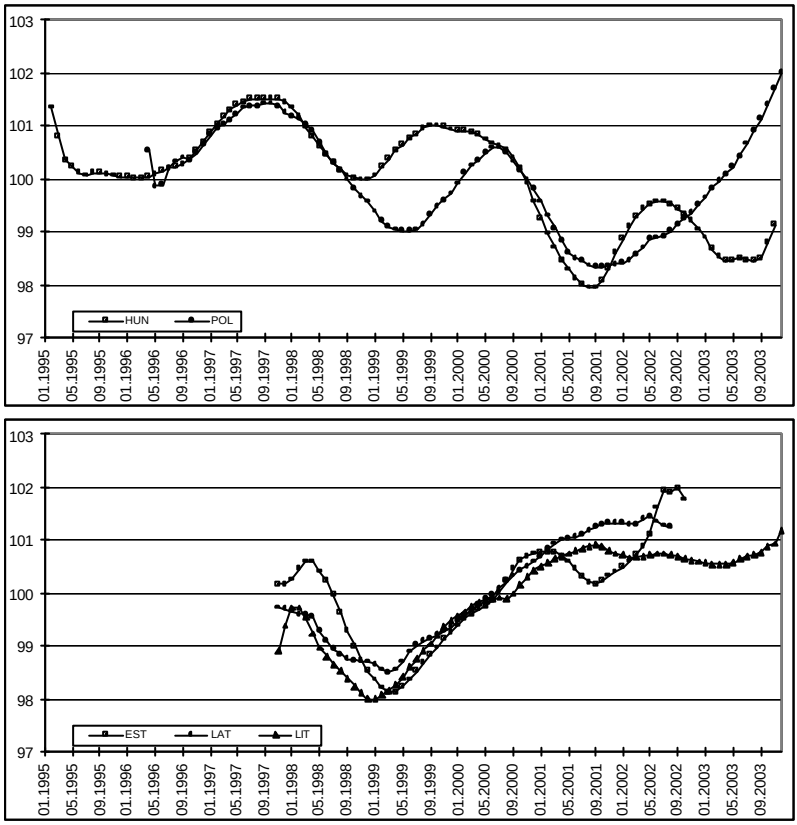


Figure 7. Industrial confidence indicators





The predominance of grey cells in the table means that the new EU entrants from the CEE area have generally revealed a good cyclical conformity among themselves. The best conformity is found between the neighbour countries, with close economic ties. This concerns, quite naturally, the Czech Republic and the Slovak Republic, two parts of the former Czechoslovakia. Much of the same applies to the Baltic states, even though Lithuania rather diverges from Estonia. Poland and Hungary, although weakly or negatively correlated with the other CEE countries, are quite well correlated between themselves. Slovenia shows some correlation with Hungary, Slovakia and Estonia, though the last one may be spurious.

The conformity of cyclical fluctuations within the group, as reflected by the industrial production growth rates, is illustrated by Figure 6. It has been split into three separate graphs showing cyclical developments in three subgroups: (a) the Czech Republic, Slovakia, and Slovenia; (b) Hungary and Poland; (c) the Baltic states: Lithuania, Latvia, and Estonia. The graphs show quite a good similarity of cyclical fluctuations in each subgroup. This division of the analysed group does not mean that the group as a whole does not reveal any cyclical convergence. Since 1997 cyclical tendencies in all the CEE countries were more or less similar until the slowdown in 2000-01. Since 2002 most CEE economies reveal again a quite vigorous growth. Thus, we are allowed to say that the CEE countries as a group have revealed over the whole period quite a good cyclical convergence.

Industrial confidence

It is also interesting to check cyclical convergence within this group in the light of the survey data on industrial confidence indicator.

Since industrial confidence indicators are usually stationary, we simply use their deseasonalised 2000=100 indexes, with no allowance for trend. Correlation coefficients between industrial confidence indicators in individual CEE countries are presented in Table 4, and their time series are shown in Figure 7.

Table 4. Correlation coefficients of industrial confidence

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
CZE	1.00	-0.45	*ns*	0.80	0.78	0.50	0.64	0.66
HUN	-0.45	1.00	0.57	-0.33	0.25	-0.43	-0.73	-0.71
POL	*ns*	0.57	1.00	0.35	0.52	*ns*	-0.48	*ns*
SLK	0.80	-0.33	0.35	1.00	0.72	0.68	0.55	0.70
SLO	0.78	0.25	0.52	0.72	1.00	0.40	0.26	0.44
EST	0.50	-0.43	*ns*	0.68	0.40	1.00	0.83	0.81
LAT	0.64	-0.73	-0.48	0.55	0.26	0.83	1.00	0.97
LIT	0.66	-0.71	*ns*	0.70	0.44	0.81	0.97	1.00

ns – not significant.

In general, industrial confidence indicators compile from business surveys are well correlated with the industrial production index. This is why the results obtained from the analysis of both indicators are more or less similar.

The analysis of the industrial confidence indicators generally supports our findings based on the examination of the industrial production index. The group as a whole shows quite a good synchronisation of cyclical movements, the more so when it is divided into three subgroups as before.

Hungary is well correlated with Poland. The Czech Republic and the Slovak Republic are very well correlated between themselves, and also with Slovenia. The Baltic states are almost perfectly correlated between themselves. The correlation for the whole group is weaker, but still significant except the divergence between the developments in Poland and Hungary on the one part and the Czech Republic and the Baltic states on the other.

The major limitation of our analysis is the shortness of the available time series, covering just 6-9 years. Therefore, the results should be interpreted with caution. We can hope that after the EU accession, the countries of this group will maintain their mutual links. If it is so, they may continue to display similar trends in their economic development, especially within the regional subgroups.

4.3. Cyclical convergence with the euro area

As the CEE countries are heavily engaged in economic cooperation and increasingly integrated with the EU, we may suppose that they also reveal a cyclical convergence towards the EU.

Table 5. Correlation coefficients between industrial production in the euro area and in the new EU countries

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
EURO	-0.25	0.91	0.29	*ns*	0.65	*ns*	*ns*	-0.32

ns – not significant.

Table 6. Correlation coefficients between industrial confidence in the euro area and in the new EU countries

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
EURO	0.55	0.58	0.35	0.36	0.74	*ns*	*ns*	*ns*

ns – not significant.

Figure 8. Industrial production growth rates in the euro area and in the new EU countries

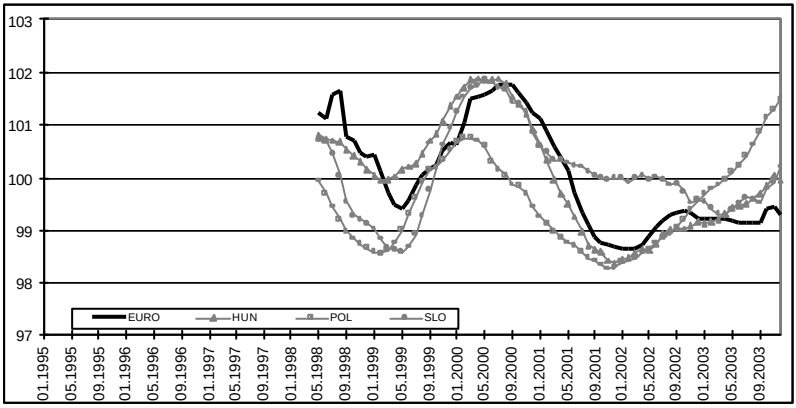
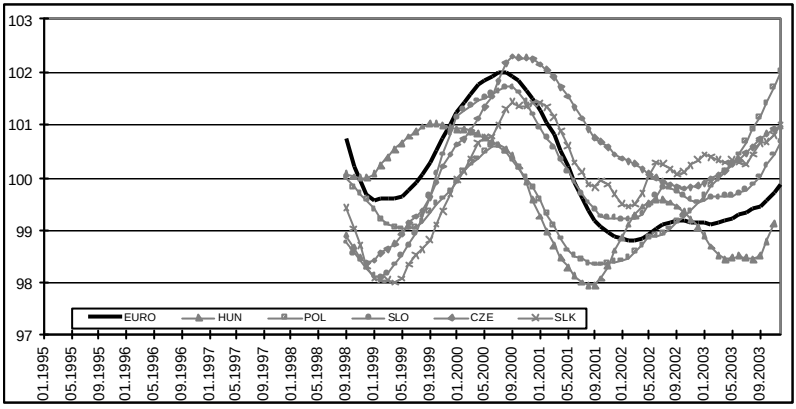


Figure 9. Industrial confidence in the euro area
and in the selected EU accession countries



To verify this hypothesis, we compare industrial production indexes and industrial confidence indicators of each of the EU accession country of CEE with the analogous indices for the euro area (EU-12). The period covered by this part of the analysis is shorter because the euro area exists since 1998. The methods used are the same as in the previous section.

Correlation coefficients are presented in Tables 5 and 6. In terms of the industrial production growth rates Hungary, Slovenia, and Poland reveal significantly positive correlation with the euro area. In terms of industrial confidence indicators almost all CEE countries, save the Baltic states, reveal quite a good correspondence with cyclical developments in the euro area. Figures 8 and 9 show the similarity between cyclical fluctuations in the selected CEE countries and the euro area, as reflected by the industrial production growth rates and industrial confidence indicators, though at the end of period there is a divergence between the slack in the euro area and a continuous growth in most CEE countries. Our analysis suggests that there is a significant symmetry in business cycles between the CEE countries and the euro area. This is mainly due to intensive trade and capital flows, but also due to similar reactions to the external demand

and supply shocks. After the EU accession this tendency can become even more pronounced.

The newest EBRD report on transition (EBRD, 2003, p. 49-51) brings another attempt to evidence cyclical convergence between the CEE accession countries and the euro area. Co-movements in business cycles in the period 1993-2003 are shown on graphs as the difference between output gaps in each CEE country and the eurozone. Output gaps have been calculated as the difference between actual and trend output as measured by the quarterly volume index of GDP and its HP trend. Though the interpretation of the alleged tendency towards cyclical conformity with EU is quite convincing, the empirical evidence is not so clear. The graphs reveal some similarity of business cycles between CEE countries, but no clear-cut tendency towards their convergence with the euro area.

5. Trade links

To assess the significance of our findings about economic convergence among the CEE accession countries and their convergence towards the EU, we should analyse their trade links which constitute the main transmission channel of international cooperation. Trade flows, notably exports, are especially important in any reasoning about the business cycle synchronisation while capital flows and labour movement may be more pertinent to growth convergence. Trade links of the CEE countries can be reconstructed on the basis of the EBRD and IMF data on the directions of trade.

Table 7 shows main directions of trade in CEE countries as percent of their total exports and imports. Within-the-region trade now represents only about 10% of their total trade whereas the trade with the EU-15 amounts to more than 60% of the total. For the countries most integrated with the EU (the Czech Republic, Poland, Slovenia, and Hungary) this share is between 65 and 70%, and for the remaining CEE countries it is between 50 and 60%. The share of

intra-regional trade tends to be inversely related to the intensity of trade with the EU, ranging from 6% in Hungary and Slovenia, 10% in Poland, 12-14% in the Czech Republic and the Baltic states, to 24% in the Slovak Republic. There are many reasons for a relatively slight intra-regional trade, including substitutive rather than complementary production structures, relatively low international competitiveness of many export products, and weak capital links. The common tendency to sell more than to buy from the neighbour is also hampering mutual exchange. As a result, despite all the efforts to promote regional trade under CEFTA, its share in total CEE trade between 1995 and 2002 rather decreased while the share of trade with the EU increased considerably.

Table7. Directions of trade in CEE countries
(percent of total exports and imports)

Country	Year	Within the group			With the EU		
		Exp.	Imp.	Avg.	Exp.	Imp.	Avg.
CZE	1995	25.4	14.8	20.1	54.0	55.9	55.0
	2002	15.8	8.7	12.3	68.8	71.7	70.3
SLK	1995	45.8	30.6	38.2	37.4	34.8	36.1
	2002	28.4	19.9	24.2	59.5	52.3	55.9
SLO	1995	5.0	6.2	5.6	67.3	69.3	68.3
	2002	7.7	6.8	7.3	61.9	72.0	67.0
HUN	1995	8.4	5.6	7.0	62.8	61.5	62.2
	2002	6.6	5.1	5.9	73.5	57.5	65.5
POL	1995	6.7	6.3	6.5	70.1	64.7	67.4
	2002	11.8	8.0	9.9	67.6	67.5	67.6
EST	1995	25.4	14.8	20.1	54.0	55.9	55.0
	2002	15.8	8.7	12.3	68.8	71.7	70.3
LAT	1995	12.3	12.4	12.4	44.2	50.0	47.1
	2002	13.8	15.0	14.4	62.3	52.3	57.3
LIT	1995	14.1	5.8	10.0	36.4	37.2	36.8
	2002	24.1	4.0	14.1	47.1	51.2	49.2
Avg.	1995	17.9	12.1	15.0	53.3	53.7	53.5
	2002	15.5	9.5	12.6	63.7	62.0	62.9

Source: EBRD, *Transition Report 2003: Integration and Regional Cooperation*, London 2003, p. 86, table A. 4. 1. 1. Averages were calculated by the authors.

Tables 8 and 9 bring more detailed information about the trade links between CEE countries and their major trade partners. There is some discrepancy between the data included in Table 7 (taken from the EBRD report) and the data appearing in Tables 8 and 9 (compiled by ourselves). Though all data are based on the same source (IMF), our own estimates as regards CEE intra-regional trade and their trade with EU differ from those calculated by the EBRD. For most countries the difference is not big, except for Estonia. One of the reasons may be the difference between the original data reported by this country and the IMF estimates derived from cross-country data.

Significant trade links of CEE countries, as reflected by the partner's share of more than 5% in their total exports and imports, have been marked by grey cells. Such links only exist between the Czech Republic and Slovak Republic and among the Baltic states. Slovakia has also significant exports to Hungary and Poland. For Slovenia, Hungary and Poland, the CEE market is less important. At the same time, all CEE countries are heavily dependent on the EU markets. The share of CEE exports to the EU ranges from 48% in Lithuania to 75% in Hungary while the share of imports from the EU is between 49% in Lithuania and 62% in Poland.

Germany, as the largest single economy within the EU, is the major trade partner to all the CEE accession countries except of Estonia (which is more linked with Finland and Sweden). For Lithuania, Germany is the main source of imports and the second biggest export market (after the U.K.). Russia remains an important source of imports (mainly of oil, gas and other raw materials) for most CEE countries (except of Slovenia). Russia is also an important export market for the Slovak Republic and the Baltic states, but no more for the remaining CEE countries. However, all the CEE countries are quite sensitive to political and economic developments in Russia because of their dependence on energy supplies, substantial capital flows, and the impact of political developments.

Table 8. CEE exports by trading partners in 2002
(percent of total exports)

*	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT	CEE8	EU15	GER
CZE	-	2.4	4.7	7.7	0.6	0.1	0.2	0.4	16.1	68.6	36.6
HUN	1.9	-	2.1	1.5	0.9	0.1	0.1	0.2	6.8	75.0	35.5
POL	4.0	2.3	-	1.4	0.3	0.3	0.7	2.3	11.3	68.8	32.3
SLK	15.2	5.5	5.3	-	1.0	0.0	0.2	0.6	27.8	60.6	26.0
SLO	1.8	1.8	2.8	1.2	-	0.0	0.1	0.3	8.0	59.3	24.7
EST	0.3	1.0	0.9	0.1	0.0	-	7.7	4.1	14.1	57.2	8.3
LAT	0.6	0.4	1.5	0.4	0.1	5.9	-	8.2	17.1	59.6	15.3
LIT	0.5	0.5	3.5	0.1	0.0	3.8	9.7	-	18.1	48.4	10.4

* Exporting countries are listed in the first column and the recipient countries are shown at the head. *Source*: Own calculations based on IMF, *Direction of Trade Statistics*, December 2003.

Table 9. CEE imports by trading partners in 2002
(percent of total imports)

*	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT	CEE8	EU15	GER
CZE	-	2.0	4.1	5.3	0.6	0.0	0.0	0.1	12.1	61.0	32.9
HUN	2.3	-	2.5	1.8	0.6	0.1	0.0	0.1	7.4	56.2	24.2
POL	3.2	1.7	-	1.5	0.6	0.1	0.1	0.3	7.5	61.7	24.3
SLK	15.1	2.7	3.2	-	0.8	0.0	0.0	0.0	21.8	50.3	23.1
SLO	2.5		1.5	1.4	-	0.0	0.0	0.0	5.4	68.0	19.2
EST	0.9	0.4	2.4	0.2	0.2	-	2.3	2.8	9.2	54.8	11.1
LAT	1.4	0.9	5.0	0.7	0.3	6.2	-	9.8	24.3	52.9	17.2
LIT	1.4	0.8	5.0	0.3	0.5	1.1	1.7	-	10.8	48.6[c]	17.8

* Importing countries are listed in the first column and countries of origin are shown at the head.

[a] Authors' own estimate based on source data (including the estimated imports from France, reported as null).

Source: Own calculations based on IMF, *Direction of Trade Statistics*, December 2003.

This analysis indicates that all the CEE accession countries are heavily dependent on the EU market, so they are apt to follow the rhythm of the business cycle seen in the EU, especially in Germany. Intra-regional trade links may explain to some extent the similarity of

business cycles between the Czech Republic and Slovak Republic, and among the Baltic states, but not between the other CEE countries. Cyclical convergence between CEE countries and the EU is caused by the existing economic links as well as by a rising policy coordination. At the same time the conformity of cyclical patterns among CEE countries may be attributed to three factors: (a) echoing the fluctuations in the EU; (b) similar sequence of internal shocks caused by the transformation process; (c) subregional economic ties, e.g. between the Czech Republic and Slovak Republic, and between the Baltic states. The current size of intra-regional economic cooperation among the CEE countries cannot explain their tendency towards cyclical convergence within the group.

Since the current shares of CEE trade with the EU-15 are already high and significant reductions in trade barriers have taken place before the actual enlargement, we should not expect a big increase in trade and capital flows after the EU accession. Cyclical convergence towards EU may nevertheless improve with the resulting more symmetry in cyclical movements among CEE economies.

6. Summary

1) There is a clear-cut convergence among the eight EU accession countries of CEE as to their income levels. The GDP growth rates in the period 1993-2003 were generally negatively correlated with the initial GDP *per capita* level. Income differences between individual countries tend to diminish, especially during the last few years.
2) As regards cyclical convergence, CEE countries should be divided into three subgroups: (a) Czech Republic and Slovak Republic; (b) Hungary and Poland; (c) the Baltic states. Slovenia may be included in one of the two first subgroups. Each subgroup reveals a good conformity of cyclical fluctuations while the correlation with other subgroups is weak.

3) All the considered CEE countries reveal a strong economic convergence towards the EU, both as regards income levels and business cycles. The accession countries tend to develop faster than the elder EU members. As the result, the income gap between CEE and EU is generally decreasing, although it still remains very large. Most CEE countries also reveal quite a good conformity of cyclical fluctuations with the euro area.
4) The existing trade and capital links between CEE countries and the EU are already quite strong. Therefore, we should not expect a major improvement in real economic convergence just after the accession. Moreover, some divergence tendencies cannot be excluded.
5) The major limitation of our research is the relatively short period covered by the analysis. The research on the subject should be continued after the EU accession.

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